WHAT IS CLAIMED IS:

1. A method of withdrawal and return of blood in a patient undergoing extracorporeal blood treatment therapy comprising:

a. inserting a dual lumen catheter into a surface peripheral vein in an extremity of the patient;

b. advancing the catheter into a venous tree of the patient towards the heart a distance in a range of 20 centimeters (cm) to 45 cm;

c. positioning a distal tip of the catheter beyond venous flappers in the venous tree;

d. drawing blood from the catheter through an inlet opening in the distal tip;

e. applying an extracorporeal treatment to the blood, and

f. returning the treated blood to patient through the catheter.

2. A method as in claim 1 wherein the distal tip of the catheter is positioned in the venous tree in a shoulder region of the patient.

3. A method as in claim 1 wherein the treated blood is infused through an opening in the catheter and into the peripheral vein upstream in a blood flow moving towards the catheter tip.

4. A method as in 1 where the treatment is ultrafiltration and the catheter is positioned in the venous tree for a period of at least 4 hours.

5. A method as in 1 where the treatment is hemofiltration and the catheter is positioned in the venous tree for a period of at least 4 hours.

6. A method as in 1 where the treatment is dialysis and the catheter is positioned in the venous tree for a period of at least 4 hours.

7. A method as in 1 where the treatment is selected from a group consisting of: collecting platelet, collecting peripheral blood stem cells and performing a therapeutic aphaeresis procedure.

8. A method as in claim 1 where the catheter is inserted a length in a range of 20 cm to 45 cm into the peripheral vein and venous tree, and the treated blood is infused through an opening in the catheter at least 10 centimeters (cm) from an inlet to the catheter.

9. A method as in claim 1 where the insertion of the catheter is at an elbow level of an arm of the patient.

10. A method as in claim 1 wherein the catheter has a constant outside insertable diameter in a range of 1.5 millimeter (mm) to 2.3 mm.

11. A method as in claim 1 wherein the catheter has a total insertable tube length of no greater than 45 cm.

12. A method as in claim 1 wherein the dual lumen catheter further comprises a withdrawal lumen having a first cross-sectional internal lumen area along a dual lumen section and a second cross-sectional internal lumen area along a single lumen section distal to the dual lumen section, and wherein the second cross-sectional internal lumen area is at least 10% greater than the first cross-sectional internal lumen area.

13. A method as in claim 1 wherein the catheter has an infusion internal cross sectional lumen area in a range of 0.5 to and including 0.8 mm^2.

14. A method as in claim 1, wherein the catheter is inserted into a native peripheral vein.

15. A method as in claim 1 wherein the treated blood is returned at a location in the peripheral vein upstream in the venous tree of the position of the inlet opening into which blood is drawn, and further comprising recirculating a portion of the treated blood returned through the catheter by drawing the treated blood into the inlet opening as the treated blood flows through the venous tree and to the inlet opening.

16. A method as in claim 15 where an amount of recirculation is no greater than 33% of an amount of blood drawn into the inlet opening.

17. A method as in claim 1 wherein the treated blood is discharged from the catheter through a sidewall opening in the catheter.

18. A method as in claim 1 wherein the treated blood is discharged from an opening in the catheter and the opening is at least 10 cm upstream of the catheter from the inlet opening.

19. A method as in claim 1 wherein the treated blood is discharged from an opening in the catheter and the opening is at least 3 cm and no more than 10 cm distal from a catheter hub.

20. A method as in claim 1 wherein treated blood is discharged from an opening in an infusion lumen of the catheter and the opening has a cross sectional area at least equal to a cross sectional area of the infusion lumen in an insertable section of the catheter.

21. A method as in claim 1 wherein treated blood is discharged from a plurality of openings in an infusion lumen of the catheter and the openings have a combined cross sectional area at least equal to a cross sectional area of the infusion lumen in the insertable section of the catheter.

22. A method as in claim 1 wherein treated blood is discharged from an opening in an infusion lumen of the catheter and a non-discrete mark is located on said catheter within 0.5 cm of the opening.

23. A method as in claim 1 further comprising applying a reduced or negative pressure to a withdrawal lumen of the catheter to draw blood into the input opening.

24. A method as in claim 23 wherein the reduced pressure draws blood from the reservoir of blood in the patient upstream through the vein into the withdrawal catheter.

25. A method as in claim 1 further comprising applying a positive pressure to an infusion lumen of the catheter to move the treated blood and return the treated blood to the patient.

26. A method as in claim 1 where the extracorporeal treatment step further comprises: filtering blood drawing through the catheter to separate excess fluid from the blood, wherein filtered blood is the treated blood to be returned to the patient.

27. A method as in claim 26 wherein blood flow rate through a filter is less than two percent of a total cardiac output of the patient, and a flow rate of the excess fluid removed from the blood is at a rate no greater than 1.0 liters per hour.

28. A method as in claim 1 wherein a rate at which blood is withdrawn from the patient is no greater than 40 milliliters per minute.

29. A method as in claim 26, wherein a rate at which blood is withdrawn from the patient is in a range of 40 millimeters to 60 milliliters per minute, and a rate of removal of the excess fluid is at a rate no greater than 1.0 liters per hour.

30. A method as in claim 26, wherein the filtration is ultrafiltration.

31. A method as in claim 1, wherein the surface peripheral blood vessel is a basilic vein.

32. A method as in claim 1, wherein the surface peripheral blood vessel is a cephalic vein.

33. A dual lumen catheter for withdrawing blood and returning treated blood through a peripheral vein of a patient, said catheter comprising:

a catheter tube having an insertable length of at least 10 cm, wherein said insertable length further comprises a proximal dual lumen section having a withdrawal lumen and an infusion lumen, and wherein said withdrawal lumen continues as a single lumen distal to the dual lumen section.

34. A catheter as in claim 33 wherein the catheter has a substantially uniform cross-sectional periphery along the insertable length.

35. A catheter as in claim 33 wherein the catheter is formed of 90 to 110 Shore A polyurethane.

36. A catheter as in claim 33 further comprising a fluid withdrawal inlet opening within two cm of a distal tip of the withdrawal lumen.

37. A catheter as in claim 34 wherein fluid return is performed through a lumen outlet opening at least 10 cm proximal to the withdrawal lumen inlet opening.

38. A catheter as in claim 33 wherein an internal cross sectional area of the fluid withdrawal lumen is substantially larger in the single lumen portion of the catheter than in the double lumen portion.

39. A catheter as in claim 33 wherein the single lumen portion is at least 10 cm.

40. A catheter as in claim 33 wherein an internal cross sectional area of the fluid withdrawal lumen transitions over a length of 1 to 3 mm from a small area to a

larger area in a section of the catheter proximal to a transition from the dual lumen to single lumen sections.

41. A catheter as in claim 33 wherein the transition of the fluid withdrawal lumen cross section forms an angle of no greater than 45°.

42. A catheter as in claim 33 wherein a cross-section of a fluid withdrawal lumen is 100% to 175% larger in a distal portion of the catheter than in a proximal dual lumen portion of the catheter.

43. A catheter as in claim 33 wherein a fluid withdrawal lumen distal opening has at least one opening in a sidewall of the catheter with a combined opening cross sectional area of at least as great as a cross section of withdrawal lumen adjacent the distal opening.

44. A catheter as in claim 33 wherein the fluid withdrawal lumen includes an inlet opening at a catheter tip and a plurality of sidewall inlet openings in a side wall of the lumen, wherein the sidewall inlet openings are within two cm of the catheter tip.

45. A catheter as in claim 33 wherein the withdrawal lumen further comprises a tapered tip having at least one opening in a tapered side wall.

46. A catheter as in claim 33 wherein a blood pump applies a negative pressure to an inlet of the withdrawal lumen in a range of negative 100 to negative 300 millimeters of mercury.

47. A catheter as in claim 33 wherein a blood pump applies a negative pressure to an inlet of the withdrawal lumen in a range of negative 150 to negative 200 millimeters of mercury.

48. A dual lumen catheter for withdrawing blood and returning treated blood through a peripheral vein of a patient, said catheter comprising:

a catheter tube having an insertable portion adapted to be inserted into the peripheral vein;

an infusion lumen within said catheter extending through a portion of the insertable portion of the catheter tube;

a withdrawal lumen within said catheter tube further comprising a first withdrawal section extending parallel to said infusion lumen and a second withdrawal

section contiguous with the first withdrawal section, wherein said second withdrawal section extends distally beyond said infusion lumen.

49. A dual lumen catheter as in claim 48 wherein said catheter tube has a constant outside diameter section extending along its insertable length to a distal tip portion of the catheter.

50. A dual lumen catheter as in claim 49 wherein the distal tip portion is tapered and has a decreasing cross-sectional area.

51. A dual lumen catheter as in claim 48 wherein said infusion lumen and first withdrawal section are separated by a septum wall that terminates at a transition between the first withdrawal section and the section withdrawal section.

52. A dual lumen catheter as in claim 51 wherein the septum wall is helical at least at a distal section of the wall.

53. A dual lumen catheter as in claim 51 wherein the infusion lumen further comprises a first infusion opening and a second infusion opening angularly offset from the first infusion opening.

54. A dual lumen catheter as in claim 53 wherein the angular offset is at least 60 degrees.

55. A dual lumen catheter as in claim 48 further comprising a tube reinforcing member in a section of tube wall at least adjacent the infusion lumen.

56. A dual lumen catheter as in claim 55 wherein said reinforcing member further comprises an gap aligned with an infusion opening in said infusion lumen.

57. A dual lumen catheter as in claim 55 wherein said reinforcing member comprises a coil embedded in said tube wall adjacent an infusion opening in said infusion lumen.

58. A dual lumen catheter as in claim 57 wherein said coil includes at least one incomplete winding between opposite complete windings extending completely around said tube wall, and wherein said at least one incomplete winding is aligned with the infusion opening.

59. A dual lumen catheter as in claim 57 wherein said coil further comprises a first coil and a second coil, embedded in said tube wall on opposite sides of the infusion opening.

60. A dual lumen catheter as in claim 55 wherein said reinforcing member comprises an increase of the durometer of the catheter tube at a tube section including the infusion opening.

61. A dual lumen catheter as in claim 60 wherein said durometer increase is to a durometer of 55 to 75 shore D.

62. A dual lumen catheter as in claim 60 wherein the tube section extends a distance no more than 1.5 cm from either end of the infusion opening.

63. A dual lumen catheter as in claim 55 wherein said reinforcing member comprises a ridged tubing section along a tube section including the infusion opening.

64. A dual lumen catheter as in claim 64 wherein the tube section extends a distance no more than 1.5 cm from either end of the infusion opening.

65. A dual lumen catheter as in claim 48 where said insertable length is at least 20 cm and said infusion lumen has an insertable length of less than 10 cm.

66. A dual lumen catheter as in claim 48 further comprising a large diameter section of said catheter tube including both said infusion lumen and said withdrawal lumen, wherein said large diameter section is proximal to said insertable portion, and said insertable portion is smaller in diameter than is said large diameter section.

67. A dual lumen catheter as in claim 66 wherein a cross-sectional area of said withdrawal lumen contracts at an interface between the large diameter section of the catheter tube and the first withdrawal section, and expands at an area between the first withdrawal section and the second withdrawal section.

68. A dual lumen catheter as in claim 48 further comprising a distal withdrawal opening at a distal end of the second withdrawal section, proximal withdrawal opening in the first withdrawal section, and an infusion opening at a distal end of the infusion lumen.

69. A dual lumen catheter as in claim 68 wherein said proximal withdrawal opening is adjacent the infusion opening.